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S&H Form: (10/01)

REPLY/AMENDMENT FEE TRANSMITTAL

Attorney Docket No.	392.1716
Application Number	09/871,642
Filing Date	June 4, 2001
First Named Inventor	Tomonaga YAMAMOTO, et al.
Group Art Unit	2834
Examiner Name	H. Elkassabgi

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AMOUNT ENCLOSED	110.00

FEE CALCULATION (fees effective 10/01/01)

CLAIMS AS AMENDED	Claims Remaining After Amendment		Highest Number Previously Paid For	Number Extra	Rate	Calculations
TOTAL CLAIMS	14	-	20 =	0	X $ 18.00 =	$ 0.00
INDEPENDENT CLAIMS	2	-	3 =	0	X $ 84.00 =	0.00

Since an Official Action set an original due date of October 18, 2002, petition is hereby made for an extension to cover the date this reply is filed for which the requisite fee is enclosed (1 month ($110); 2 months ($400); 3 months ($920); 4 months ($1,440); 5 months ($1,960)):	110.00
If Notice of Appeal is enclosed, add ($320)	
If Statutory Disclaimer under Rule 20(d) is enclosed, add fee ($110)	
Total of above Calculations =	$ 110.00
Reduction by 50% for filing by small entity (37 CFR 1.9, 1.27 & 1.28)	
TOTAL FEES DUE =	$ 110.00

(1) If entry (1) is less than entry (2), entry (3) is "0".
(2) If entry (2) is less than 20, change entry (2) to "20".
(4) If entry (4) is less than entry (5), entry (6) is "0".
(5) If entry (5) is less than 3, change entry (5) to "3".

METHOD OF PAYMENT

☒ Check enclosed as payment.

☐ Charge "TOTAL FEES DUE" to the Deposit Account No. below.

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GENERAL AUTHORIZATION

☒ If the above-noted "AMOUNT ENCLOSED" is not correct, the Commissioner is hereby authorized to credit any overpayment or charge any additional fees necessary to:

Deposit Account No.	19-3935
Deposit Account Name	STAAS & HALSEY LLP

☒ The Commissioner is also authorized to credit any overpayments or charge any additional fees required under 37 CFR 1.16 (filing fees) or 37 CFR 1.17 (processing fees) during the prosecution of this application, including any related application(s) claiming benefit hereof pursuant to 35 USC § 120 (e.g., continuations/divisionals/CIPs under 37 CFR 1.53(b) and/or continuations/divisionals/CPAs under 37 CFR 1.53(d)) to maintain pendency hereof or of any such related application.

SUBMITTED BY: STAAS & HALSEY LLP

Typed Name	Michael J. Badagliacca	Reg. No.	39,099
Signature	M Badagliacca	Date	11-18-02

Docket No.: 392.1716

10/Ltr. Respnse w/att. w/att.
11/22/02

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the Application of:

Tomonaga YAMAMOTO, et al.

Serial No. 09/871,642 Group Art Unit: 2834

Confirmation No. 9776

Filed: June 4, 2001 Examiner: H. Elkassabgi

For: A ROTOR FOR A SYNCHRONOUS MOTOR DEFINED BY A HYPERBOLIC FUNCTION (AS AMENDED)

RESPONSE

Assistant Commissioner for Patents
Washington, D.C. 20231

Sir:

This is in response to the Office Action mailed July 18, 2002, and having a period for response set to expire on October 18, 2002. A petition for a one-month extension of time is enclosed herewith, thereby extending the period for response to November 18, 2002.

The following remarks are respectfully submitted. Reconsideration of the claims is respectfully requested.

REMARKS

INTRODUCTION:

Claims 1-14 are pending and under consideration.

REJECTION UNDER 35 U.S.C. §102:

Claims 1-14 are rejected under 35 U.S.C. §102(b) as being anticipated by Nitta et al. Independent claim 1 recites an "outer periphery of one pole of the rotor, in a cross section perpendicular to a central axis of the rotor, is defined by a curve of a hyperbolic function." Independent claim 8 recites "an outer edge that is defined by a curve of a hyperbolic function."

These features are illustrated, for example, in FIG. 1 of the present application. Accordingly, at least a part of the outer periphery of one pole of the rotor has a curve defined by:

$R(\theta)=A-B(e^{C\theta}+e^{-C\theta})/2$ .....(1)

According to the Examiner, Nitta et al. discloses this feature by the following formulas:

$r(\theta)-rc\pm(H(\theta)-rc)$ .....(2)

$H(\theta)=\{(\cos^2\varphi+4^*a^*rc^*\sin^2\varphi)^{1/2}-\cos\varphi\}/(2^*a^*\sin^2\varphi)$

However, as discussed below, the Applicants respectfully disagree.

As a preliminary matter, it is noted with respect to expressions of e^x, sin x and cos x by power series functions, the function e^x is a monotonically increasing function whereas sin x and cos x are periodic functions, as shown in attached Exhibit I. Thus, the function e^x is quite different from the functions sin x and cos x although expressions of these functions by power series have similar forms. Therefore, the hyperbolic function cosh $(x)-(e^x+e^{-x})/2$, which includes the function e^x, is substantially different from equation (2) in the Nitta et al. reference, which includes the functions sin x and cos x. Also, as can be seen from the graphs in Exhibit I, the hyperbolic function cosh $(x)=(c^x|e^Y)/2$ has a simple form which is obtained by dividing the sum of the monotonically increasing function c^x and the monotonically decreasing function e^x by "2".

In Exhibit I, it should be noted that $e^{x/2.5}$, $e^{-x/2.5}$ and cosh(x/2.5) are used instead of e^x, e^{-x} and cosh (x), respectively, for the sake of appropriately plotting the graphs within one coordinate system.

According to the Examiner, equation (1) of the present invention can be transformed to be substantially equal to equation (2) of the Nitta et al. reference. However, for these equations to be equivalent, the $R(\theta)$ values would have to be equal at at least three points. As discussed below, there does not exist any equation (1) of the present invention having three points in common with equation (2) of Nitta et al. Thus, equation (1) of the present invention can not be obtained by transforming equation (2) of the Nitta et al. reference.

In Nitta et al., "rc" represents a distance from a center of rotation to a central part of an outer face of the permanent magnet, and "rb" represents a distance from the center of rotation to a pole border on the outer face of the permanent magnet, and "P" represents the number of poles of the permanent magnet.

Also, in equation (2) of Nitta et al., the values of $r(0)$ in the case of the number of poles "P"=4 are shown in Table 1 at page (6) of the reference. Three points are selected in Table 1, as shown below.

Point (a): θ=0.000[rad]=0.000[deg], r=23.3 which is the distance "rc"

Point (b): θ=0.349[rad]=20.000[deg], r=22.33

Point (c): θ=0.785[rad]=45.000[deg], r-20.8 which is the distance "rb"

Equation (1) of the present invention has three parameters of A, B and C. It will be determined whether or not there exist the parameters A, B and C to fulfill equation (1) representing the curve lying on the three points (a), (b) and (c).

First, by substituting the above values of θ and "r" at points (a), (b) and (c) for θ and "R" in equation (1) of the present invention, we obtain the following:

23.3=A-Bcosh(C*0)=A-B ...(3) ($\because$ cosh (0)-(e^0+e^{-0})/2-(1+1)/2-1)

2.33=A-Bcosh(C*0.349) ...(4)

20.8=A-Bcosh(C*0.785) ...(5)

The following equation (6) is obtained from equation (3).

A=23.3+B ...(6)

By substituting the right side of equation (6) for "A" in equation (4), we obtain the following:

22.33=23.3+B-B*cosh(C*0.349), and therefore

B=0.97/{1-cosh(C*0.349)} ...(7)

By substituting the right sides of equations (6) and (7) in equation (5), we obtain the following:

20.8=23.3+B-B*cosh(C*0.785)

=23.3+B*{1-cosh(C*0.785)}

=23.3-0.97/{1-cosh(C*0.349)}{1-cosh(C*0.785)}

$-2.5=-0.97/\{1-\cosh(C*0.349)\}\{1-\cosh(C*0.785)\}$

$-2.5*\{1-\cosh(C*0.349)\}-*0.97\ \{1-\cosh(C*0.785)\}$

$2.5*\cosh(C*0.349)\}-0.97*\cosh(C*0.785)\}=1.53$ ...(8)

Using $F(C)=2.5*\cosh(C*0.349)-0.97*\cosh\ (C*0.785)-1.53$, equation (8) is expressed as $F(c)-0$. The graph of equation $F(C)=0$ is shown in Exhibit II.

As can be seen from Exhibit II, the parameter C satisfying $F(C)=0$ is determined to be 0. According to equation (7), when $C=0$, $B-\infty$. Therefore, there is no solution of equation (1) of the present invention fulfilling the values of the three points (a), (b) and (c).

Thus, it has been proved that there is not any equation (1) of the present invention representing a curve lying on the three points (a), (b) and (c) existing on the curve of equation (a) of the Nitta et al. reference. Thus, equation (2) of Nitta et al. is not equivalent to equation (1) of the present invention.

The following is an example of the curve of equation (1) of the present invention in comparison with the curve of equation (2) of Nitta et al.

The curve of equation (2) of Nitta et al. when $rc=23.3$, $rb=20.8$, and $P=4$ is shown in exhibit III. Also, the curve according to equation (1) of the present invention having two common points at $\theta=0$ and $\theta=45$ having values 24, 0.7 and 0.357 of the parameters A, B and C, respectively, is shown in exhibit III. As can be seen from exhibit III, the two graphs do not coincide with each other.

It is noted that there is a typographical error of "$a=(2^{1/2}*d-2*rc)/d^{2}$" which should be "$a=-(2^{1/2}*d-2*rc)/d^{2}$" in a calculation for obtaining the values of $r(\theta)$ according to equation (2) of the Nitta et al. reference.

In the above example, the shape of the outer periphery of the central portion of each pole of the rotor with θ ranging between 0° and 20° contributes the output torque of the synchronous motor such that the output torque increases as the gap between the outer periphery of the rotor and an inner periphery of the stator decreases.

The shape of the outer periphery in the side portion of each pole of the rotor with θ ranging between 30° and 45° contributes the inductance of the motor such that the inductance increases as the gap between the outer periphery of the rotor and inner periphery of the stator is larger. The small inductance results in increase of the output torque at high speed rotation.

As can be seen from exhibit III, the curv according to equation (1) of the present invention realizes increase of the output torque and also decrease of the inductance. However, according to the curve of equation (2) of Nitta et al., the inductance is reduced relative to the curve of the hyperbolic function of the present invention but the output torque is made quite small. Thus, large torque and small inductance are not achieved.

Accordingly, withdrawal of the rejection of independent claims 1 and 8, and claims 2-7 and 9-14 depending therefrom is requested.

CONCLUSION:

There being no further outstanding objections or rejections, it is submitted that the application is in condition for allowance. An early action to that effect is courteously solicited.

Finally, if there are any formal matters remaining after this response, the Examiner is requested to telephone the undersigned to attend to these matters.

If there are any additional fees associated with filing of this response, please charge the same to our Deposit Account No. 19-3935.

Respectfully submitted,

STAAS & HALSEY LLP

Date: 11-18-02

By: M. Badagliacca

Michael J. Badagliacca
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EXHIBIT I

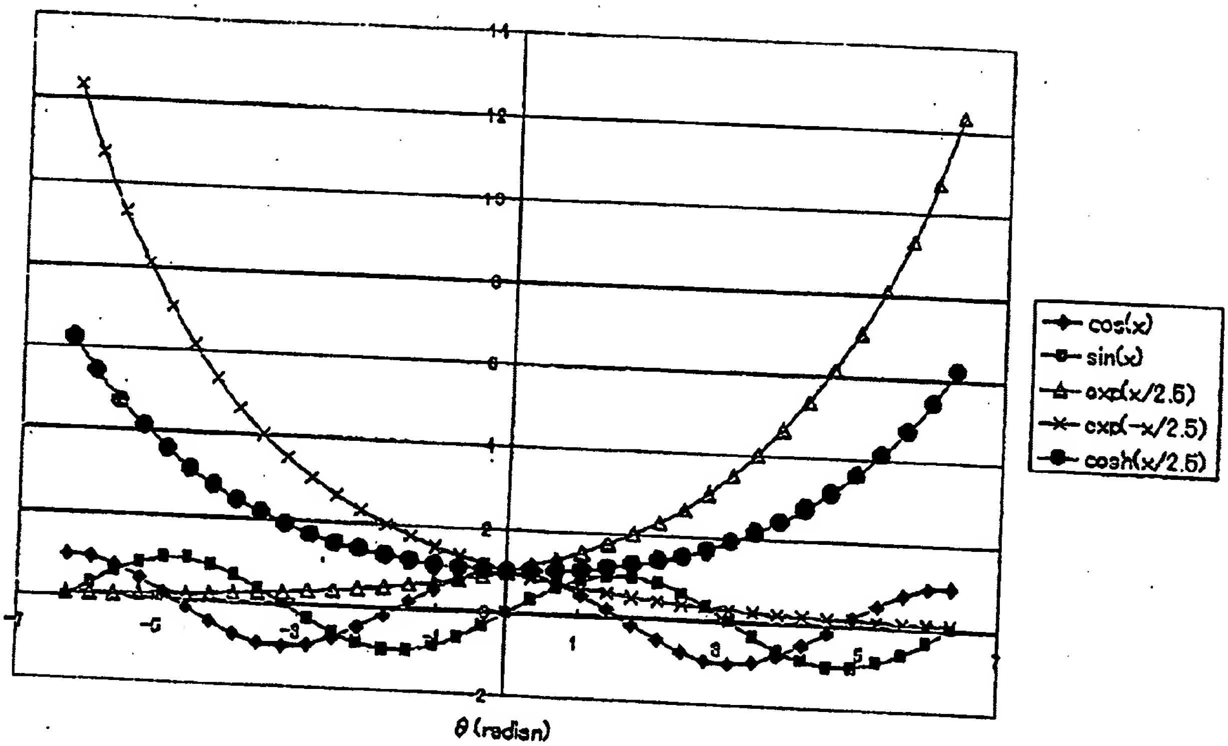

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EXHIBIT II

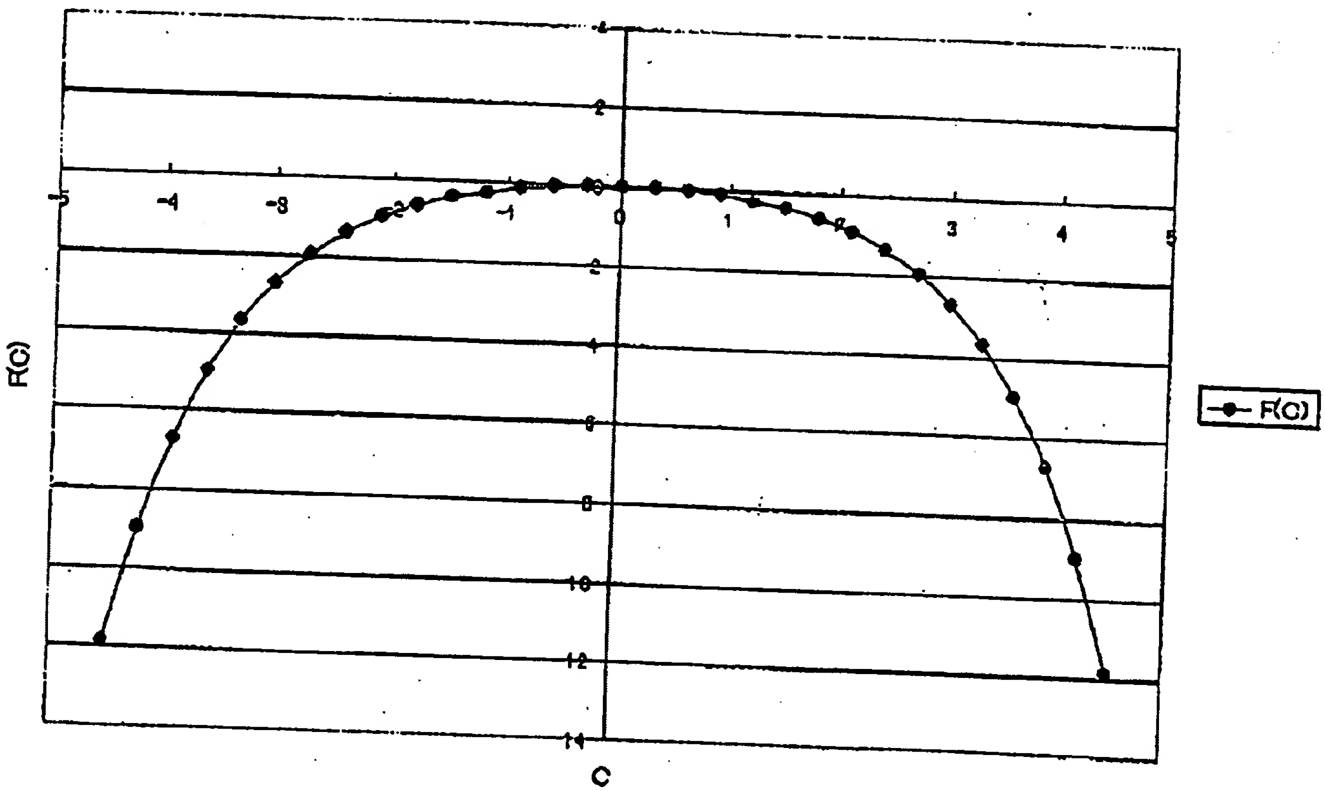

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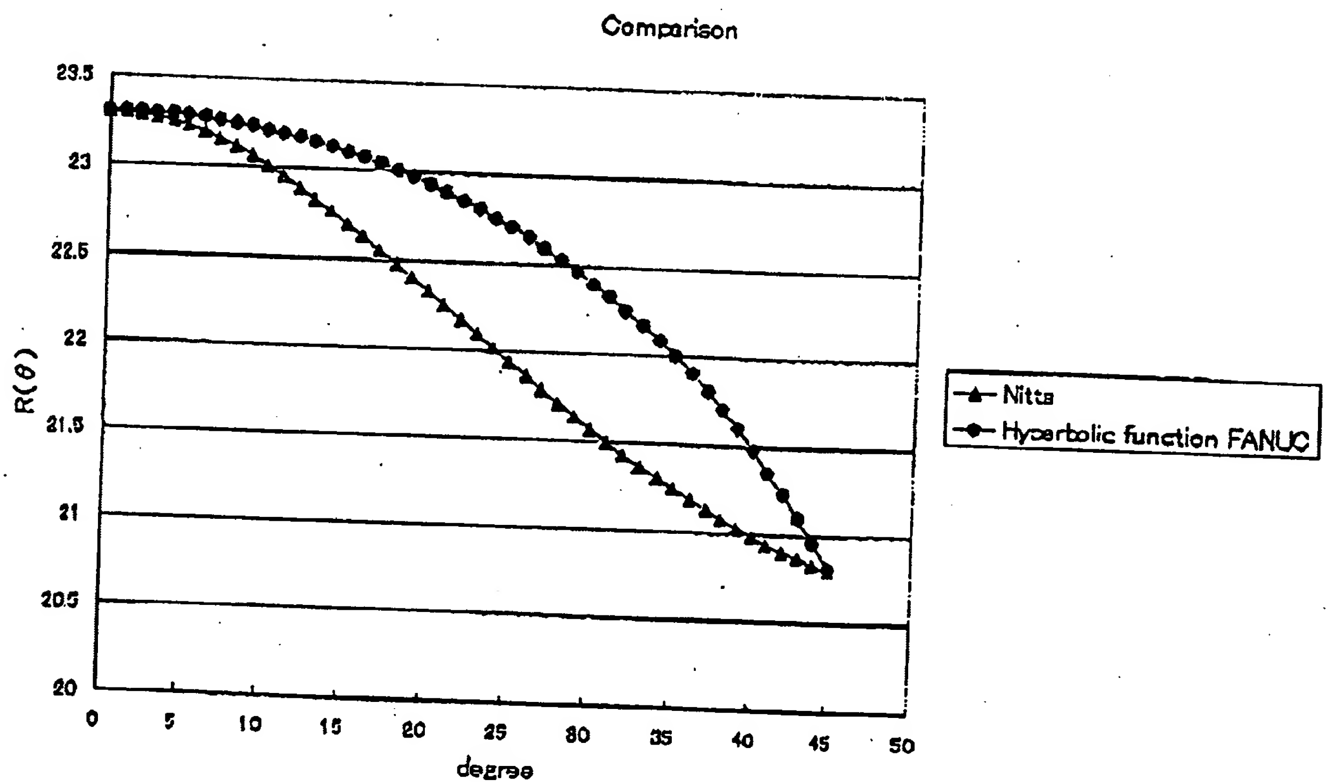
EXHIBIT III


Comparison
23.5
23
22.5
22
21.5
21
20.5
20
R(θ)
0
5
10
15
20
25
30
35
40
45
50
degree
Nitta
Hyperbolic function FANUC